

WHAT IS CLAIMED IS:

- 1 1. A method for determining the wear to a storage battery by monitoring
2 the state of charge of the storage battery, the method comprising:
3 identifying a plurality of deep discharge events when a state of charge
4 value for the storage battery is less than a minimum state of charge value specified for
5 the storage battery;
6 determining the duration of the plurality of deep discharge events; and
7 determining a wear variable which characterizes the wear as a function
8 of the total number and the total duration of the plurality of deep discharge events;
9 wherein the wear variable increases as the total number and the total
10 duration of the deep discharge events increases.
- 1 2. The method of Claim 1 wherein the wear variable is determined
2 according to a function such that the wear variable increases more than proportionally
3 with the total number of deep discharge events.
- 1 3. The method of Claim 1 wherein the wear variable is determined
2 according to a function such that the wear variable increases more than proportionally
3 with the total duration of the deep discharge events.
- 1 4. The method of Claim 1 wherein only those deep discharge events
2 whose duration exceeds a defined minimum duration are assessed in order to
3 determine the total number.
- 1 5. The method of Claim 4 wherein the defined minimum duration is
2 defined as a function of at least one of the ambient temperature and the battery
3 temperature.
- 1 6. The method of Claim 4 wherein the defined minimum duration has a
2 value of between approximately 0.1 and 100 hours at room temperature.

1 7. The method of Claim 1 further comprising determining a loss of
2 storage capacity for the storage battery in proportion to the wear variable on the basis
3 of a storage capacity of the storage battery at a previous defined time.

1 8. The method of Claim 7 wherein the storage capacity of the storage
2 battery at the previous defined time is the storage capacity of the storage battery when
3 the storage battery was new, and wherein the wear variable at the defined time is set
4 to zero.

1 9. The method of Claim 7 further comprising determining a first wear
2 component that is dependent on the total number of identified deep discharge events.

1 10. The method of Claim 9 wherein the first wear component has a value
2 of between 0.1% and 50% of the storage capacity of the storage battery at the
3 previous defined time after a first deep discharge event.

1 11. The method of Claim 10 wherein the first wear component has a value
2 of between 0.3% and 5% after the first deep discharge event at a battery temperature
3 of approximately 20°C.

1 12. The method of Claim 9 wherein the first wear component has a value
2 of between 1% and 20% of the storage capacity of the storage battery at the previous
3 defined time after a first deep discharge event.

1 13. The method of Claim 12 wherein the first wear component has a value
2 of between 0.3% and 5% after the first deep discharge event at a battery temperature
3 of approximately 20°C.

1 14. The method of Claim 9 further comprising determining a second wear
2 component that is dependent on the total duration of the identified deep discharge
3 events.

4 15. The method of Claim 14 wherein the second wear component has a
5 value of between 0.1% and 100% of the storage capacity of the storage battery at the
6 previous defined time after a total duration of 100 hours.

1 16. The method of Claim 15 wherein the second wear component has a
2 value of between 0.3% and 5% after a total duration of 100 hours at battery
3 temperatures in the region of 20°C.

1 17. The method of Claim 14 wherein the second wear component has a
2 value of between 0.1% and 20% of the storage capacity of the storage battery at the
3 previous defined time after a total duration of 100 hours.

1 18. The method of Claim 17 wherein the second wear component has a
2 value of between 0.3% and 5% after a total duration of 100 hours at battery
3 temperatures in the region of 20°C.

1 19. The method of Claim 1 wherein the wear variable is determined from
2 the sum of a first wear component that is dependent on the total number of deep
3 discharge events and a second wear component that is dependent on the total duration
4 of the deep discharge events.

1 20. The method of Claim 19 wherein the first wear component is
2 calculated from a first function that behaves linearly with regard to the total number
3 of deep discharge events.

1 21. The method of Claim 19 wherein the first wear component is
2 calculated from a first function that behaves more than proportionally to the total
3 number of deep discharge events.

1 22. The method of Claim 19 wherein and the second wear component is
2 calculated from a second function that behaves linearly with regard to the total
3 duration of deep discharge events.

4 23. The method of Claim 19 wherein and the second wear component is
5 calculated from a second function that behaves more than proportionally to the total
6 duration of deep discharge events.

1 24. A monitoring device for storage batteries comprising:
2 a measurement unit for measuring variables which characterize the
3 state of charge of the storage battery;
4 an evaluation unit for determining the state of charge of the storage
5 battery from the measured variables and for determining the wear of the storage
6 battery using a method comprising:
7 identifying a plurality of deep discharge events when a state of charge
8 value for the storage battery is less than a minimum state of charge value specified for
9 the storage battery;
10 determining the duration of the plurality of deep discharge events; and
11 determining a wear variable which characterizes the wear as a function
12 of the total number and the total duration of the plurality of deep discharge events;
13 wherein the wear variable increases as the total number and the total
14 duration of the deep discharge events increases.

1 25. A computer program comprising:
2 program code means;
3 wherein the program code means are designed to carry out a method
4 comprising:
5 identifying a plurality of deep discharge events when a state of charge
6 value for the storage battery is less than a minimum state of charge value specified for
7 the storage battery;
8 determining the duration of the plurality of deep discharge events; and
9 determining a wear variable which characterizes the wear as a function
10 of the total number and the total duration of the plurality of deep discharge events;
11 wherein the wear variable increases as the total number and the total
12 duration of the deep discharge events increases.